Finance and Economics Discussion Series
Divisions of Research & Statistics and Monetary Affairs
Federal Reserve Board, Washington, D.C.

Aging and Strategic Learning: The Impact of Spousal Incentives on Financial Literacy

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2011-53

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Board of Governors of the Federal Reserve System

October 9, 2011

Abstract

American women tend to be less financially literate than men, which is consistent with a household division of labor in which men manage finances. However, women also tend to outlive their husbands, so they will eventually need to take over this task. Using a new survey of older couples, I find that women acquire financial literacy as they approach widowhood. At an estimated increase of 0.04 standard deviations per year approaching widowhood, 80 percent of women in the sample would catch up with their husbands prior to the expected onset of widowhood. These findings reflect actual increases by women and are not merely an artifact of cognitive decline among older men. The results are consistent with a model in which the household division of labor breaks down when a spouse dies: women have incentives both to delay acquiring financial knowledge and also to begin learning before widowhood. This paper represents the first empirical examination of the financial literacy of both members of couples and provides a life-cycle interpretation of the gender gap in financial literacy.

*Many thanks to Robert Willis, Jeff Smith, Matthew Shapiro, Miles Kimball, Raj Arunachalam, Annamaria Lusardi, Shanthi Ramnath, Brian Kovak, Brooke Helppie McFall, Marta Murray-Close, Pamela Giustinelli, Michael Gideon, and participants at numerous seminars and conferences for helpful comments and suggestions. The author gratefully acknowledges support received at the University of Michigan from the National Institute on Aging grant 2P01AG026571 and graduate fellowship support from the Networks Financial Institute at Indiana State University. The analysis and conclusions set forth are those of the author and do not indicate concurrence by other members of the research staff or the Board of Governors.

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1 Introduction

Empirical studies have found that women tend to have, on average, lower levels of financial literacy than men (Fonseca et al., 2010; Lusardi and Mitchell, 2008; Kotlikoff and Bernheim, 2001). This gap may reflect a division of labor within the household such that men are responsible for financial matters. However, women also tend to outlive their husbands, so they will eventually need to take over this task. Women therefore have an incentive both to delay acquiring financial knowledge and also to begin learning prior to widowhood. Financial literacy is a critical form of financial knowledge that is linked to important economic outcomes. Economists view investment in human capital as a purposive process, and in this paper, I show that the acquisition of financial literacy is no different.

This paper presents a model of the human capital investment process of longer-lived spouses over the life cycle and tests the model's predictions using innovative new data on financial literacy and financial decision-making. The management of household finances is likely to both be subject to a division of labor and to be taken care of by men, who will most likely be survived by their wives. I show that the prospect of widowhood provides an incentive for women to accumulate financial literacy. In particular, the model generates three results. First, if the household finances are managed by their husbands, women may rationally delay learning about finances. Secondly, investments in financial knowledge should increase as widowhood becomes more imminent; lastly, longer durations of widowhood provide additional incentives for accumulating more human capital.

While I analyze the model specifically for women and financial literacy, the model is generalizable to any task specialized in by the shorter living spouse. Using a cross-sectional sample that links husbands and wives, I use variation in the husbands' life expectancies to analyze how women accumulate human capital relative to their husbands (who do not have this incentive to increase learning in old age) as women approach widowhood. I find that women increase their financial literacy as they approach widowhood. At an estimated increase of 0.04 standard deviations per year approaching widowhood, 80 percent of women in my sample would catch up with their husbands prior to the expected onset of widowhood.

Financial knowledge is critical due to its relationship to economic outcomes and its policy implications. Financial literacy is linked to financial decision-making and outcomes, including more effective wealth management (Hilgert et al., 2003), better management of credit and debt (Hilgert et al., 2003; Lusardi and Tufano, 2009), retirement planning (Lusardi and Mitchell, 2007, 2009), increased saving (Kotlikoff and Bernheim, 2001; Carlin and Robinson, 2010), and higher stock market participation (Delavande et al., 2008; Van Rooij et al., 2011). Given these links, having sufficient financial literacy is becoming even more important since

the responsibility for retirement planning has shifted to individuals. Wealth management has become increasingly complex as predictable streams of retirement income from defined benefit pensions have been replaced by defined contribution plans that need to be managed both before and after retirement (Mitchell and Schieber, 1998). In addition, financial literacy has become a prominent policy issue. While the government identified increasing financial literacy as a policy goal in 2003 (Fair and Accurate Transaction Act), this goal has become an even higher priority in the wake of the 2008 economic crisis. The large numbers of foreclosures, defaults, and debt problems that arose during the housing and financial crisis highlight the costs of financial illiteracy for individuals with low and high levels of wealth. Furthermore, policy proposals to privatize Social Security would introduce further individual responsibility for retirement planning and require even more knowledge.

This paper makes a number of contributions. This is, to my knowledge, the first study to analyze investments in financial knowledge in a life-cycle framework. While a number of studies have shown that women have lower levels of financial literacy than men, I show that women accumulate knowledge as they approach widowhood, suggesting that a gender gap in financial literacy may reflect strategic responses of women to incentives over the life cycle.

Second, this paper is the first to link the financial knowledge of the two members of a couple. By using the *spousal* gap in financial literacy rather than differences between women and men in different households, I can investigate how financial knowledge relates to the division of labor over the life cycle. I also use a detailed set of cognitive measures to show that the narrowing of the wife-husband gap in financial knowledge reflects advances on the part of women and is not merely an artifact of men's cognitive decline.

This paper combines ideas about the household division of labor with human capital theory. Section 2 provides additional background on financial knowledge as human capital in the context of the household division of labor and widowhood. Section 3 presents a theoretical model of the timing of a woman's investment in financial human capital over her lifetime. Section 4 describes the data used, and Section 5 presents evidence that older women acquire financial knowledge as widowhood approaches. These effects remain even when controlling for the cognitive decline of the husband. Section 6 concludes.

2 Financial literacy, human capital, and specialization

The management of household finances is an important type of non-market production that requires its own form of human capital. One major component of this human capital is financial literacy. There is increasing public and scholarly interest in financial literacy and informed financial decision-making, in part because of the poor financial outcomes that are

associated with low levels of financial literacy: problems with debt (Lusardi and Tufano, 2009) and lack of retirement planning (Lusardi and Mitchell, 2007, 2009), among others. At the same time, studies have found that Americans tend to display low levels of financial literacy (Bernheim, 1998; Hilgert et al., 2003; Lusardi and Tufano, 2009). In particular, Lusardi and Mitchell (2011) find that financial illiteracy is widespread among older Americans. Recent government policies, including the establishment of the Consumer Financial Protection Bureau, aim to increase financial literacy among the public.

Studies have shown that women tend to have lower levels of financial literacy than men (Fonseca et al., 2010; Lusardi and Mitchell, 2008; Kotlikoff and Bernheim, 2001). This is true even for younger women (Lusardi et al., 2010; Chen and Volpe, 2002), in spite of the gains in educational attainment younger women have made relative to men. Low levels of financial literacy may not be problematic if one's partner has higher literacy and specializes in managing household finances. As Becker (1985) shows, under a number of assumptions, it is efficient for members of a household to specialize in particular tasks. However, such reliance on a partner can have serious consequences when one is unable to divide tasks among household members either before the formation of a household or during widowhood.

In American households, men are usually primarily responsible for household finances.[1] In the Cognitive Economics Study used in this paper, only 16 percent of couples report that the woman is the most financially knowledgeable person in the household. A person may become the financial specialist in a couple for a number of reasons. First, the person with a greater stock of financial knowledge when entering the marriage might be more likely to specialize; this could favor the older member of the couple, typically the man. This advantage may arise from past experience with money and finances, possibly through one's occupation. Educational sorting may play a role, if college-educated women were more likely to major in non-quantitative fields. Second, in addition to the initial stock of knowledge however acquired, another factor may simply be interest or enthusiasm on the part of the specialist, or fear or avoidance on the part of the non-specialist. Third, the division of labor may also be a product of intra-household bargaining. Whatever the root causes, women tend to be less financially literate than men. Since women are likely to outlive men, this leads again to the question of what happens when this division of labor is no longer sustainable.

Indeed, some economists have shown that the expected duration of a household affects

[1]Another form of non-market production is the management of health and medical matters. In the United States, women tend to specialize in these matters. Studies show between 60 to 80 percent of women are primary decision makers about health care (including selecting doctors and health insurance) for their families, with an additional 18 to 22 percent reporting making joint decisions with partners or spouses (Salganicoff et al., 2002, 2005). Critically, however, men are much less likely to outlive a spouse and be tasked with replicating this knowledge.

how labor is divided. Johnson and Skinner (1986) find that greater divorce risk increases the labor supply of women, and Stratton (2005) shows that cohabitating couples, whose relationships are typically shorter in duration than those of married couples, have less intra-household specialization in housework than married couples. While widowhood is a completely different form of relationship termination, it operates similarly by ending a person's ability to reap the benefits of specialization. This suggests that the nature of the division of labor within a household changes over time and therefore calls for continued investment.

Widowhood is a very likely outcome for most married women, who not only face longer life expectancies than men but are also typically younger than their husbands. According to 1995 marital status life tables, 75 percent of marriages not ending in divorce end in widowhood (Schoen and Standish, 2001). Furthermore, the mean duration of widowhood in the Health and Retirement Study is about nine years (author's own calculations). Although the gender disparity in life expectancies has changed over time, widowed women still outnumbered widowed men four to one in 2009 (U.S. Census Bureau, 2010). The prospect of many years without the couple's financial specialist creates incentives for women to prepare by acquiring financial knowledge.[2]

The notion that financial knowledge is a form of human capital was introduced in Delavande et al. (2008), which related the production of human capital to portfolio choice. Human capital accumulation is purposive based on its costs and benefits, and likewise, financial illiteracy or lack of financial knowledge can be costly for widows for a number of reasons. Even a widow who plans to delegate the management of her finances to a professional or a relative needs enough knowledge to choose someone trustworthy and to recognize if she is being bilked. If she manages her own finances, she needs to be knowledgeable enough to distinguish fraudulent offers from legitimate ones. On the other hand, a widow who recognizes her lack of knowledge but does not trust any individuals or financial institutions may lose potential gains by keeping all of her money in cash. Financial illiteracy can also lead to anxiety about money. A woman with insufficient financial knowledge may find herself in widowhood without a firm understanding of how much she can afford to spend, what her holdings are, or how quickly to decumulate during widowhood.

Since investment decisions and payoffs are realized over the life cycle, an important aspect of human capital accumulation is its timing. Mincer and Polachek (1974) argue

[2]This paper focuses on the incentives created by the prospect of widowhood faced by women. Incentives may arise from other aspects of gender differences in aging and mortality. For example, a woman may plan on being responsible for finances when her husband becomes cognitively or physically impaired due to aging, if she believes these her husband's decline will occur before her own. Hsu and Willis (2011) examine the role of cognitive decline and Alzheimer's disease on financial decision-making using a longitudinal dataset. Because the empirical analysis in this paper employs a single cross-section, I cannot identify declines of husbands relative to declines of wives.

that the human capital investments and time allocation of individuals will be influenced by expectations of future family and market activities. In most applications such as formal education and on the job training (Ben-Porath, 1967), it is advantageous to invest early to capture the longest stream of benefits. On the other hand, some investments (such as religious devotion as investment in the afterlife, studied by Azzi and Ehrenberg (1975)) may not yield benefits until much later in life, so the payoffs to such investments should increase with age. Similarly, household specialization creates delays in the returns to investing in knowledge related to the spouse's tasks. The time horizon for the payoffs also affects the benefits to human capital; Jayachandran and Lleras-Muney (2009) find that an increase in women's life expectancy increases human capital investments in girls in Sri Lanka.

In this paper, I develop a simple model to analyze the timing of human capital investments in the spouse's tasks and the effects of differing time horizons arising from gender differences in life expectancies. Using an innovative new dataset, I study the financial knowledge of husbands and wives, and in doing so I am able to learn more about an aspect of household production that is not well understood. One theme underpinning the human capital literature is that investments are purposive, and I show that the timing of investments in financial human capital is purposive as well.

3 Theoretical framework

This section presents a simple model to build intuition for the effects at play. To model the woman's decision to accumulate human capital related to something in which she does not specialize, consider a time span that begins with marriage ($t = 0$) and lasts until the end of the wife's life in period T. The woman will outlive her husband, who passes away at time D (see Figure 1). Therefore, widowhood spans from time D to T. Assume the husband specializes in household finances from the beginning of the marriage.

Assume further that non-wage financial resources can only be used if at least one person in the household has financial knowledge. A new widow with no financial knowledge will not be able to access any non-wage financial resources until she acquires some financial knowledge.[3] In this case, smoothing of consumption implies that a widow will want at least some financial knowledge at the time of widowhood. This is most realistic in a situation in which the husband was wholly responsible for all household financial matters.

A woman only begins to use this financial knowledge after her husband dies, after which

[3]Or, one could hire a professional to manage finances, which incurs a monetary rather than time cost. Doing so also requires enough knowledge to evaluate the abilities or trustworthiness of potential advisors and to monitor their activities.

the returns to her stock of financial human capital K are $v(K)$ annually until her death. The present discounted value (after depreciation) of a marginal unit of financial human capital over the course of her life is then:

$$P_t = \begin{cases} [\beta(1-\delta)]^{D-t} \sum_{j=0}^{T-D} \beta^j v'(K_t) & \text{if } t < D \\ \sum_{j=0}^{T-t} \beta^j v'(K_t) & \text{if } t \geq D \end{cases}$$

where β is the subjective discount factor and δ is the depreciation rate of human capital. Prior to widowhood, the value of a marginal increase in financial human capital is the present value of the stream of annual benefits realized during widowhood for a total of $T - D$ years, discounted by the number of years a woman must wait until the stream begins ($D - t$ years). At time zero, the present value of the benefits are low due to the D-year delay until widowhood. The value increases as a woman approaches widowhood, at which point it declines because of the decreasing number of years the knowledge can be used.

Assuming that units of human capital have a constant marginal product, and that it is independent of the number of units newly acquired or of the current stock of knowledge, the time path of P_t follows Figure 2. P_t can therefore be interpreted as the demand for financial human capital at time t.

This demand is time variant, so a marginal cost curve is required to pin down the time-path of human capital investments. Time allocated to acquiring financial knowledge will be at the expense of other activities. In its simplest form, assume that this marginal cost curve is upward sloping and fixed over time, with its position determined by underlying ability. In this case, as P_t shifts upward, a woman will acquire more human capital until widowhood (with the rate of accumulation increasing with age), after which point she will no longer acquire more units, as the costs exceed the benefits. She will therefore use whatever human capital she acquired by time D for the duration of widowhood.

The derivative of P_t with respect to the time to widowhood D is

$$\frac{dP_t}{dD} = [\beta(1-\delta)]^{D-t} \frac{1}{1-\beta} \left(\beta^T ln\beta + (\beta - \beta^{T+1-D}) ln[\beta(1-\delta)] \right) < 0. \quad (1)$$

The negative sign of this derivative confirms the intuition that one approaches widowhood, the marginal benefit increases.

The derivative with respect to the length of widowhood (holding D constant):

$$\frac{dP_t}{d(T-D)} = -[\beta(1-\delta)]^{D-t}\frac{1}{1-\beta}\beta^{T+1-D}ln\beta > 0. \tag{2}$$

Therefore, the shorter the time to widowhood, the greater the demand for financial human capital. The longer the duration of widowhood, the greater the demand for financial knowledge. The ratio of the magnitude of the two derivatives is

$$\frac{-\frac{dP_t}{dD}}{\frac{dP_t}{d(T-D)}} = \frac{\beta^T ln\beta + (\beta - \beta^{T+1-D})ln[\beta(1-\delta)]}{\beta^{T+1-D}ln\beta}. \tag{3}$$

Assuming $\beta = 0.97$ [4] and $\delta = 0.03$, with D the time to widowhood and $T-D$ the length of widowhood, the mean ratio in my sample ranges from 1.53 to 3.28 (see Table 1). The ratio is larger the more imminent widowhood is and the longer the duration of widowhood. The ratio is also larger the greater the depreciation rate of human capital and the lower the discount factor β. Therefore, the effect of the time to widowhood on the acquisition of financial literacy should be greater in magnitude than the effect of the duration of widowhood.

Lastly, a large depreciation rate δ of human capital also increases the incentive to delay the investment. In the context of financial knowledge, depreciation may take the form of specific knowledge becoming obsolete as financial institutions and rules change.

In sum, the model predicts that a woman will acquire financial knowledge very slowly at the beginning of the marriage and delay larger investments in human capital. The rate of investing will increase as the expected time of widowhood approaches. After her husband dies, she takes charge of the finances and accrues payoffs to her financial knowledge.

This framework is described in terms of financially specializing husbands and their wives, but it can easily apply to any couple in which one person outlives the other and the shorter living spouse specializes in at least one task. The fact that women have longer life expectancies than men and are typically younger than their husbands makes it easier to test the implications of such a model. Had the longer-living spouse specialized in household finances from the beginning, the time-path of financial human capital investments would more closely follow the Ben-Porath prediction[5] — front-loaded investments that decline over time.

[4]Gourinchas and Parker (2002) estimate a structural model using U.S. CEX data and find that high school graduates have a discount factor of 0.96 and college graduates have a discount factor of 0.97.

[5]The Ben-Porath model includes a key feature that I have dropped for simplicity: the ability of the current capital stock to increase the productivity of subsequent investments. This feature allows his model to generate a time path that begins with full time learning and drops sharply, in contrast to the smooth concave function generated by mine.

4 Data

The data for the empirical analysis come from the Cognitive Economics Survey (CogEcon),[6] which is an innovative new survey of a national sample of persons 51 and older and their spouses regardless of age. The first wave, administered in the spring and summer of 2008, includes a 24 question battery on financial literacy, detailed measures of income, wealth and portfolio allocation plus measures of risk tolerance, self-assessed financial knowledge, use of records and other sources of information and several questions on decision-making. An additional survey was administered to these respondents in 2009 to follow up after the onset of the economic downturn beginning in the fall of 2008.

These respondents also participated in the Cognition and Aging in the USA study (Cog-USA),[7] which includes an extremely detailed cognitive assessment. In addition, respondents were asked questions about their subjective expectations, including their subjective survival probabilities. The combined survey allows for the linking of cognitive and economic measures. Furthermore, unlike many other studies that designate one financial respondent in a household, this study collects measures of financial decision-making and financial knowledge from both husbands and wives.

Because the model predicts that women will increase their financial knowledge acquisition prior to the death of their spouses, the empirical analysis requires measures of the expected time of widowhood. Life expectancies and survival probabilities for CogEcon respondents are drawn from 2004 period life tables published by the National Center for Health Statistics.[8] As a robustness check, I use alternative survival measures from subjective survival questions as well as objective survival probabilities predicted using the Health and Retirement Study, a much larger scale longitudinal survey of similarly-aged individuals.[9] These measures are described in more detail in Appendix C.

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[6]The Cognitive Economics Survey is supported by NIA program project P01 AG026571, "Behavior on Surveys and in the Economy Using HRS," Robert J. Willis, PI. In addition to Willis, University of Michigan faculty Gwen Fisher, Miles Kimball, Matthew Shapiro, and Tyler Shumway and graduate students Brooke Helppie and Joanne Hsu had roles in designing and fielding the CogEcon study.

[7]The CogUSA Study is sponsored by the National Institute of Aging, grant number R37 AG007137, "Assessing and Improving Cognitive Measurements in the HRS," John J. McArdle, PI.

[8]These life tables, by age and sex, are found in Tables 2 and 3 from Arias (2007) and were the most up-to-date versions published by the National Center for Health Statistics at the time the CogEcon Survey was fielded.

[9]The HRS is sponsored by the National Institute of Aging (grant number NIA U01AG009740) and is conducted by the University of Michigan. Some variables were provided by the RAND HRS Data file (RAND HRS Data, 2010). See http://hrsonline.isr.umich.edu for more information.

4.1 Sample and demographics

CogEcon collects information from 748 unique households[10], defined as couples or individuals without partners. The analysis sample includes 233 couples in which both members have participated in the survey (466 respondents). 286 unmarried respondents also participated in the survey. An additional 229 respondents have partners about whom we have partial or no information due to complete or partial non-response. Further information about response rates and the derivation of the analysis sample can be found in Appendix A.

Table 2 reports the demographic characteristics of all respondents with spouses in the sample. The average age of women is 60.5 years, with men about 2.5 years older. According to life tables, these women face a life expectancy of 24 years, while their husbands have a mean life expectancy of about 19 years. Men have slightly more education than women in this sample. Only 16 percent of wives report being most knowledgeable about finances.

4.2 Outcomes of interest: financial knowledge

General financial literacy

The survey includes a financial literacy battery of 24 questions. Each presents a statement, and the respondent is asked whether s/he thinks the statement is true or false, and how sure s/he is of that that response on a 12-point scale based on her/his degree of certainty (see Figure 3). Whether a respondent sees the true or false version of a question is randomized. Questions are converted to the true version so that the scale can be interpreted as "0% surely (correct answer)" to "100% surely (correct answer)." The responses are re-scaled to a zero-one scale.[11] An individual's financial sophistication score is calculated by taking each respondent's mean score across questions in the battery and normalizing across all survey respondents. A within-couple relative score is computed using the wife-husband difference in normalized mean scores.

Topics covered include interest compounding, diversification and risk, financial terms, stock market concepts, taxation, and inflation. For the full text of each question, see Appendix A.3. To account for the fact that not all respondents participate in the stock market,

[10]Three same-sex households are excluded as there are no established patterns that indicate that the shorter-living member is more likely to be the financial specialist in such couples.

[11]The re-scaling is based on the assumption that respondents have in mind a probability that the statement in the question is true, and they select their answer choice by rounding off their probability to the nearest choice on our 12-point scale. We can then construct intervals within which a respondent would round to each answer choice, and the point-value we assign is the midpoint of this interval. For instance, those who believe a statement is true with certainties between 95 percent and 100 percent would round up to 100 percent surely true, so that choice is assigned the value 0.975.

some analyses will employ a financial literacy score that excludes the fifteen stock related questions. As can be seen in the summary statistics in Table 3, men have, on average, higher levels of financial literacy than women whether or not stock questions are included.

Additional outcomes

The survey also includes other measures of financial knowledge, which I analyze separately. The 2008 survey asks each respondent to rate his own ability to deal with day-to-day financial matters and his understanding of the stock market. In 2009, respondents were asked how often they follow the stock market, as well as whether they think stock returns have exceeded bond returns over the last 100 years. Respondents' beliefs about stock market returns, as well as the extent to which they follow the market, complement financial literacy as measures of general knowledge because they have direct bearing on financial planning, stock market participation, and investment behavior. Correct beliefs about stock market returns may also reflect greater involvement in household investments.

4.3 Cognitive ability and health measures

While the model emphasizes the effect of a spouse's mortality on the division of labor, a spouse's declining cognition or health status are other factors that would similarly necessitate learning about his tasks. Summary statistics for these factors are reported in Table 3.

One of the most widely accepted theories of cognitive abilities is that of fluid and crystallized intelligence (*Gf-Gc* theory) (Cattell, 1941; Horn, 1965; Horn and Cattell, 1966, 1967). Primary abilities are divided into two broad dimensions: fluid intelligence (Gf) and crystallized intelligence (Gc). Fluid intelligence represents reasoning abilities that result from biological influences on intellectual development, such as heredity or injuries to the nervous system. Crystallized intelligence refers to the use of accumulated knowledge and skill and represents the results of educational investments and experience rather than underlying ability. The distinction between fluid and crystallized intelligence is similar to the notion of ability versus human capital in labor economics.

Financial literacy can be interpreted both as a form of human capital as well as a form of crystallized intelligence. While crystallized intelligence tends to increase through the accumulation of knowledge, fluid intelligence peaks early in life and declines over the remaining life cycle. Psychologists have verified that fluid intelligence declines with age (McArdle et al., 2007; Verhaeghen and Salthouse, 1997; McArdle et al., 2002). Other broad cognitive abilities within the *Gf-Gc* framework that decline strongly with age include processing speed and memory (McArdle et al., 2002). Measures of speed typically share about 75 percent of

the age-related variance of other measures of cognition (Salthouse, 2000). Declines in speed and memory have even been shown to precede declines in fluid intelligence (McArdle et al., 2000).[12] Measures of fluid intelligence, memory, and processing speed can thus be used to control for the cognitive decline of respondents and to conduct robustness checks.

Fluid intelligence is measured using a normalized W-score of the Woodcock-Johnson III (WJ-III) Number Series test. Respondents are given a sequence of numbers with a missing number, and they are asked the value of the missing number. The WJ-III Visual Matching test, a measure of processing speed, asks respondents to locate the two identical numbers within a row of six numbers. Memory is measured using the WJ-III Auditory Working Memory test. After listening to a series of numbers and words, the respondent is asked to reorder the information by repeating in sequential order first the objects then the numbers. Lastly, the Wechsler Adult Intelligence Scale (WAIS) Matrix Reasoning T-score is a measure of non-verbal fluid intelligence. The W-scores and T-scores used by psychologists are scaled using large external norming samples, but here I standardize the scores among all CogUSA respondents for easier interpretation. In the analysis sample, men tend to have higher Number Series scores, but lower processing speed and memory scores, than women (see Table 3).[13]

Additional cognition measures can be used in place of financial knowledge as outcomes in falsification tests. In addition to the aforementioned measures of fluid intelligence, memory, and processing speed, I also use measures of verbal reasoning and numeracy/mathematical skill. The WJ-III Verbal Analogies test measures the respondent's ability to reason using lexical knowledge; it is a verbal measure of fluid intelligence. Lastly, numeracy or mathematical skill is measured with the WJ-III Calculation test. The Number Series and Calculation tests are the two scores that are most highly correlated with financial literacy.

In addition to his cognitive decline, a husband's poor physical health may also contribute to a woman taking over his tasks. One overall measure of health is the question, "Would you say your health is excellent, very good, good, fair, or poor?" This self-rated health measure is coded from 1 (for poor) and 5 (for excellent). Women rate their health slightly higher than men (see Table 3), though this difference is not statistically significant.

[12]Furthermore, episodic memory is typically among the first cognitive functions to deteriorate during aging (Backman et al., 2001).

[13]The difference between men and women's Matrix Reasoning scores is not statistically significant.

5 Empirical results and discussion

5.1 The CFO and the household division of labor

The most direct question related to household division of labor asks "Which member of the immediate family is most knowledgeable about your family's assets, debts, and retirement planning?" Respondents may specify "me," "my spouse/partner," "both me and my spouse/partner," or "someone else in the family" as the household's "Chief Financial Officer." About 16 percent of women in couples report being most knowledgeable, and less than half report being at least equally knowledgeable (see Table 2).

A unique advantage of the CogEcon study is that it poses the same questions to both members of a couple whenever possible. Table 4 cross-tabulates the two members' responses to the question about who is most financially knowledgeable within the household. 65 percent of these married couples gave strongly consistent answers. This includes couples for which both specify "both of us", or one member specifies "me" and the partner/spouse specifies "my spouse/partner." Weakly consistent answers are answers that are not the same but are non-contradictory. These include cases in which one member specifies "both of us," whereas the spouse/partner chooses either "me" or "my spouse/partner," or if one member of a couple skips the question. 30 percent of married couples gave weakly consistent answers. Other combinations are contradictory and are considered inconsistent; four percent of couples fall in this category. Because of the small number of couples with inconsistent answers, the analysis will ignore these discrepancies and will generally consider the woman's response as representative of the couple.

To verify that the question on financial knowledge provides information about the division of labor, I investigate how financial knowledge relates to financial decision-making using the question "Who (among members of your immediate family) makes the decisions about how to save for retirement and other large expenses?" Responses to the two questions are highly correlated. Among those in couples, over 60 percent of respondents name the same person (or persons, in the case of the "both" answer choice) as the most knowledgeable as well as the decision-maker. Over one-third of respondents state that both members make decisions while only one is most knowledgeable, and 2 percent report that both are most knowledgeable but one makes the decisions. Only about two percent of respondents give inconsistent answers to the two questions — for instance, the partner is most knowledgeable, but the respondent himself makes the major decisions. Since these inconsistent responses are so few in number and because two-thirds of respondents state that decisions are made by both members of the couple, the most knowledgeable person is a meaningful measure without incorporating additional data about who makes the major decisions.

Table 5 reports characteristics of couples, by the gender of the household CFO. Only 16 percent of couples have female CFOs. The CFO tends to be more educated, have more financial literacy, and have more fluid intelligence (as measured by the Number Series score) than his or her spouse; this is true for couples with male CFOs as well as those with female CFOs. These patterns are consistent with the idea that where one spouse has a comparative advantage with respect to fluid intelligence or education, s/he becomes the CFO. The intra-couple age gap is smaller in couples with female CFOs than those with male CFOs. In addition, small differences in the Number Series score become amplified in the differences in financial literacy, which may be a product of specialization.

5.2 Descriptive non-parametric analysis: Financial literacy by age

The cross-section can be used as a synthetic cohort to see if patterns of financial knowledge within couples change with age. My model predicts that women should increase their financial knowledge as they approach widowhood. Furthermore, if their husbands' cognition and/or health deteriorate earlier than their own, women will have greater incentive to acquire more knowledge relative to their husbands. Because the survey is not currently longitudinal, there are no measurements of baseline knowledge. To measure changes in financial knowledge in the synthetic cohort, I use husbands' knowledge as a baseline for women.

Figure 4 shows the age profile of the financial sophistication score based on the husband's age. The age profile is estimated using a lowess plot (locally weighted scatterplot smoothing), which non-parametrically estimates:

$$wife's\ financial\ literacy - husband's\ financial\ literacy = f(husband's\ age). \quad (4)$$

Men's financial sophistication follows a flat or upside-down U-shape, whereas women's scores are upward sloping with respect to their husband's age, which can be seen in the graph on the left. A similar pattern emerges when stock questions are excluded (see Figure 5).

To see if this pattern holds when women are matched to their husbands, I plot the wife-husband difference in financial literacy on the right side graph of Figure 4. Within couples, the wife's score rises relative to her husband's score as he ages and his life expectancy shortens; this is true also when excluding stock questions in Figure 5. These patterns are not sensitive to bandwidth choice. Univariate regressions of the wife-husband difference in financial scores on the husband's life expectancy show the same negative relationship. The slopes for the full financial score estimate and the non-stock financial score estimate are statistically significant at the ten percent and five percent level, respectively (see Table 6). This is consistent with the notion that women acquire human capital as their husbands age.

5.2.1 Possible confounders

Is this active learning on the part of the women, in anticipation of their husbands' decline in health and cognition? The age profiles in financial knowledge detailed above are also consistent with two different explanations unrelated to my theoretical model. First, the gains in women's knowledge relative to men may not actually reflect any actual gains; women's knowledge may remain constant while their husbands' cognition declines. Secondly, older women may have been in charge of finances throughout their marriages, thereby violating the assumptions of the synthetic cohort analysis employed here, and the results may merely reflect cohort effects.

Cognitive decline of husbands One might be concerned that these age profiles are generated by older men paired with younger women, such that an increase in the wife-husband financial knowledge gap is driven solely by a decline in the husband's ability, rather than a true increase in the woman's ability. Figure 6 shows age profiles of various other cognitive scores, plotted against the husband's age (comparable to the upper left panel of Figure 4). These graphs are generated by locally weighted scatterplot (lowess) smoothing. Aside from the memory score, the cognitive measures do not generally have a wife-husband gap that increases with the husband's age. The scores for husbands and wives track each other remarkably closely by the husband's age; if anything, for Calculations and Visual Matching (a measure of processing speed), men seem to gain on women at the oldest ages. Furthermore, the Number Series scores, which have been shown to be strong predictors of financial literacy and wealth (McArdle et al., 2009), have parallel profiles for both men and women when plotted against the husband's age. These patterns suggest that the age profile of financial literacy scores does not merely track underlying patterns of cognitive decline of husbands and wives. Because the memory score is the exception, all regression analyses will include controls for the husbands' and wives' Auditory Memory Score.

Cohort effects Using the cross-section as a synthetic cohort assumes that the experiences of individuals over the age distribution of the cross-section reflect the experiences of individuals as they age through each successive cohort, as if I had observed a single cohort longitudinally.[14] An alternative hypothesis consistent with my results is that older women have been household CFOs throughout the marriage, while younger women have not. This would cause the synthetic cohort to produce spurious support for the model's predictions.

[14]One common use of the synthetic cohort is the computation of life table life expectancies, which are expected to be downward biased because younger cohorts will have the benefit of medical advances not available to those who are already elderly.

However, social changes across cohorts suggest otherwise; historical marriage and divorce patterns are likely to bias the data *against* my model's predictions. Women in younger cohorts are likely to have married at an older age, as seen in the CPS and Census data in Figure 7.[15] Although the median age of women married before 1949 (the 5th percentile in my data of the year of first marriage) was slightly higher, there was subsequently an upward trend over time. Therefore, the younger women in my sample have had greater incentive to gain financial knowledge prior to marriage. In addition, if the dispersion of power within a couple is greater when the spousal age gap is larger, we may not expect the younger spouses of the older men to have as much control over finances. Younger couples are likely to be more "egalitarian" than older couples, and therefore older women might be less likely (and older men more likely) to be household CFO.

The prospect of divorce, which has changed considerably over time, may also lead women to learn about finances earlier in life. Historical divorce rates in the United States are shown in Figure 8.[16] Although the rates were slightly higher in the mid-1940s than than in the 1950s, divorce rates climbed rapidly through the 1960s and 70s. Divorce rates remained high through the 80s and declined only more recently. The sharp increase in divorce rates would create incentives for the younger women in my sample to insure themselves by acquiring more knowledge earlier in adulthood.

These patterns, in addition to changing norms due to the rise of feminism, would create greater incentives for younger women (relative to older women) to learn early and/or become CFOs in the household. All of these cohort effects should produce downward bias on any estimates of the effects of time to widowhood on financial knowledge.

5.3 Regression analysis

Because CogEcon surveys both the husband and the wife in a couple whenever possible, I can link members of a couple for analysis. I estimate the effect of expected time to widowhood and expected length of widowhood (derivations in Appendix B) on women's financial knowledge. Table 3 reports summary statistics of the financial knowledge variables and measures of timing and duration of widowhood used in the analysis. Women have on average -0.37 standard deviations less financial literacy than their husbands, though this gap narrows to -0.31 when stock-related questions are excluded. In this sample, life tables

[15]This figure was constructed using Table MS-2 posted online by the U.S. Census Bureau at http://www.census.gov/population/www/socdemo/hh-fam.html.

[16]Statistics prior to 1950 are drawn from U.S. Bureau of the Census (1954) and are based on population figures including the armed forces overseas. Numbers from 1950 onward are from U.S. Census Bureau (2004); divorce rates for 1998-2002 exclude California, Colorado, Indiana, and Louisiana from both the numerator as well as the population denominator.

indicate an expected time to widowhood (conditional on the woman outliving the man) of about 14 years, with an expected duration of widowhood (also conditional on the woman outliving the man) of 12.9 years.[17]

Table 7 presents estimation results for the following equation:

$$d(financial\ sophistication) = \gamma_1(expected\ time\ to\ widowhood) + \gamma_2(expected\ duration\ of\ widowhood) + X\beta + \epsilon \quad (5)$$

where $d(x)$ designates the wife-husband difference in x.

The first column of Table 7 estimates the equation with no covariates, while the second column includes the usual education and health controls. Column (3) adds measures of fluid intelligence (Number Series and Matrix Reasoning), processing speed (Visual Matching), and working memory (Auditory Memory) for both husband and wife. Including these cognition variables increases the magnitude and precision of the estimated coefficient on the time to widowhood. A one-year reduction in the expected time to widowhood is associated with a statistically significant 0.04 standard deviation increase in the wife-husband difference in normalized financial sophistication, which is about 11 percent of the mean difference. This result arises even when controlling for a cognitive measures that decline markedly with age.

Several of the questions in the financial sophistication battery are related to the stock market, and these concepts may not be relevant to members of households who do not participate in the stock market. I construct a second financial literacy score from the ten questions that are unrelated to the stock market and normalize them over all respondents. Table 8 repeats the financial sophistication analysis with this smaller set of more basic literacy questions. The coefficient on the time to widowhood increases substantially in magnitude; in the specification with full controls in the third column, this coefficient increases 15 percent to -0.046 from -0.040 in Table 7. The coefficient on the expected length of widowhood is unchanged and is still statistically insignificant.

The Number Series score is a strong predictor of financial knowledge, and since this is a measure of fluid intelligence, having a higher Number Series score can be interpreted as lowering the woman's marginal cost of acquiring knowledge. A one standard deviation increase in the wife's Number Series score is associated with a 0.37 standard deviation increase in her financial sophistication relative to her husband. Coefficients on the control

[17]These figures use life table aggregate statistics from individuals of all marital statuses. This assumes that the mortality of husbands and wives are uncorrelated, and that if there is a marriage treatment effect on life expectancy, its magnitude does not differ between husbands and wives. If one does not condition on the woman outliving the husband, life tables also indicate an average life expectancy of almost 20 years for the husbands, with wife-husband difference in life expectancies of over four years. All analysis using these unconditional measures yield similar results.

variables are generally as expected: the lower the education and health levels of the husbands, the greater the woman's financial knowledge. Likewise, the greater are a woman's levels of health or education, the greater her financial knowledge, and these effects are smaller in magnitude than those of her husband's levels.

Even after including for working memory, processing speed, and an additional measure of fluid intelligence, all of which decline strongly with age and therefore help control for the husband's cognitive decline, I still find a statistically significant effect of time to widowhood on financial literacy. The magnitude of the effect is large; if all women acquired financial literacy at the estimated 0.04 standard deviation per year, almost 80 percent of women in the sample would fully catch up with their husband's current level of financial literacy before the expected onset of widowhood. The coefficients on the expected duration of widowhood are positive — the longer the length of widowhood, the more financial literacy the woman has relative to her husband — but are not statistically significant. This is consistent with the fact that the model predicts the effect of the marginal year closer widowhood should be much larger than the marginal year during widowhood.

As a robustness check, I run false regressions of equation (5) by replacing the difference in financial sophistication scores on the left hand side with differences in cognition scores. Table 9 reports the results for the six cognition scores detailed in Section 4.3. Because the left hand side variables are all wife-husband differences in normalized scores, the coefficients are directly comparable to each other. The columns are ordered from most highly correlated to least correlated to financial literacy. All of the falsification regressions have coefficients on the time to widowhood that are smaller in magnitude than the same coefficient in the financial literacy regression; two of them have positive estimated coefficients. The measure with largest negative coefficient on time to widowhood, Matrix Reasoning, is not highly correlated with financial literacy; furthermore, the main regressions in Tables 7 and 8 control for this measure of fluid intelligence. This demonstrates that the estimated effect of time to widowhood on financial literacy is not a spurious relationship solely attributable to the cognitive decline of men.

As a second robustness check, I repeat the analysis of the financial sophistication outcome using probabilistic survival measures. Instead of the life table widowhood measures used in the main analysis that mask individual variation in actual survival expectations, I use individual-specific measures drawn from subjective survival probabilities elicited on the survey and objective survival probabilities predicted using individual characteristics. Details on the derivation and interpretation of these probabilistic measures are provided in Appendix C. The results are qualitatively similar to the main analysis, again showing a negative effect of the husband's survival probability on women's financial sophistication.

5.4 Regression analysis using other outcomes

I now turn to additional measures of financial knowledge: women's self-rated financial knowledge, historical knowledge of the stock market, and how closely one follows the stock market. Because these measures are absolute levels rather than relative to their husbands, the use of the synthetic cohort for these outcomes is less compelling. Nevertheless, results from analysis using each of these measures instead of financial literacy provide additional supporting evidence that women increase knowledge as they approach widowhood.

Self-rated knowledge The CogEcon survey asks respondents the degree to which they agree with the following statements: "I am good at dealing with day-to-day financial matters, such as checking accounts, credit cards, mortgages, installment payments, and budgeting," and "I understand the stock market reasonably well." Respondents select from a six-point Likert scale, from strongly agree (six points) to strongly disagree (one point). Summary statistics for these and subsequent financial knowledge measures are reported in Table 10. On average, women report much higher levels of financial skills than stock skills. The first two columns of Table 11 show ordered probit regressions of women's self-rated measures on the expected time to widowhood, expected length of widowhood, and other control variables. Like the analysis of financial literacy, these regressions show that reductions in the time to widowhood are associated with increases in self-rated stock market knowledge and self-rated financial skills. This effect is statistically significant in the case of stock skills.

While the first two columns of Table 11 only use the wife's self-report, columns (3) and (4) use the wife-husband difference used in the financial literacy battery analysis. While the financial sophistication battery allows for an objective ratio, husbands and wives may have different cut-points on the latent variable underlying each self-reported outcome. Therefore, the self-reports may not be appropriate for use as a wife-husband relative measure. That said, these regressions still yield the expected result of negative coefficients on time to widowhood.

Historical knowledge and following the stock market Another outcome measure is knowledge about the historical returns of stocks relative to bonds. The CogEcon survey asked in a followup in 2009: "On average *over the last 100 years*, how do you think the *annual rate of return on stocks* has compared to *the annual rate of return on bonds*?" Respondents may indicate whether stock returns have been higher than bond returns, bond returns have been higher than stock returns, and both returns were the same. In the period between 1908 and 2006, the arithmetic average of annual total real stock market returns was 8.5 percent, while that of long-term government bond returns was 5.5 percent (Siegel, 2007). Answering this question correctly not only is evidence of greater financial knowledge, but

also has implications for stock market participation, retirement planning, and other financial matters. About 57 percent of women gave correct answers (see Table 10). Average marginal effects from a probit estimation with an outcome of one if respondents report that stock returns have been higher than bond returns are reported in the fifth column of Table 11. As predicted by my model, women with less time to widowhood are more likely to answer correctly, and the average marginal effect is statistically significant.

The CogEcon post-crash survey also asks respondents "How closely do you follow the stock market?" with the answer choices "very closely," "somewhat," and "not at all." Following the stock market more closely may be a sign of greater involvement in handling finances or increased learning about the economic and financial environment. An ordered probit of this question is reported in the sixth column of Table 11. As the time to widowhood shortens, women are more likely to follow the stock market more closely. This effect is consistent with women learning more about finances as they approach widowhood.

6 Conclusion

Empirical studies on financial literacy have generally shown that women have less financial knowledge than men (Fonseca et al., 2010; Lusardi and Mitchell, 2008; Kotlikoff and Bernheim, 2001). One possible explanation for this gender gap is that it reflects the household division of labor. Unequal life expectancies of household members imply that a division of labor that emerges when the couple forms will eventually change when the longer-living spouse takes over the responsibilities held by the shorter-living spouse. Household financial management is a task that is frequently the responsibility of the husband, who generally has a shorter life expectancy than the wife. Because the benefits of financial knowledge for women are not realized until she is a widow, the theoretical model predicts that a woman has an incentive to delay the acquisition of financial knowledge until later in life. Conversely, because knowledge cannot be acquired instantaneously, she also has an incentive to begin her acquisition of financial knowledge well before widowhood so that she will be equipped with the knowledge needed to manage her wealth when her husband dies.

Using matched data on wives and husbands, I show that women do indeed increase their financial knowledge on a number of dimensions as their husbands age. Women acquire financial literacy at a rate of 0.04 standard deviations per year; at this rate, about 80 percent of the women in the sample would catch up with their husbands in financial literacy before the expected onset of widowhood. In addition, women have increased self-rated financial skills and follow the stock market more closely as widowhood becomes more imminent. Because cohort effects related to age at first marriage and divorce probabilities work against

my finding a result, my estimates are underestimates of the actual effects. Furthermore, I find statistically significant effects of the time to widowhood in spite of the measurement error associated with using population-average life table calculations.

However, I do not find a statistically significant effect of the expected length of widowhood on women's financial knowledge. This may not be surprising given that the model predicts a much larger effect of time to widowhood than the length of widowhood. Assuming a discount factor of 0.97 and no depreciation, the effect of time to widowhood is predicted to be on average 50 percent larger than the duration's effect, with the gap widening if human capital is assumed to depreciate. Furthermore, while the model does not specify the functional form of the returns to financial knowledge, the financial decisions faced by widows may be less complex than the planning decisions made earlier in the life cycle. If this is the case, then the marginal returns to financial knowledge may decline sharply after a certain threshold. Women may aim to reach a level of financial knowledge at widowhood sufficient to manage their decumulation, but not necessarily so much as to make complex investment decisions.

The financial literacy outcome uses the husband's literacy as a baseline in order to identify effects from a synthetic cohort formed by a cross-section. My results show that older women do indeed plan strategically for the future by investing in financial knowledge as widowhood becomes more imminent. This supports the idea that the poor economic outcomes associated with widowhood may reflect insufficient preparation due to an unexpectedly early onset of widowhood. In addition, poor outcomes may also reflect low levels of husband's financial knowledge; in this case, merely catching up with their husbands (as most women would if they continue to acquire knowledge at the rates I have estimated) may not equip women with the tools needed to manage their finances alone.

The model can be applied not only to financial literacy but also to any other task specialized in by a spouse. In addition, the model can also be generalized to other questions related to the length of time a person can depend on a spouse to continue specializing. Korniotis and Kumar (2011) find that older investors exhibit greater investment knowledge, but that these effects are offset by the adverse effects of cognitive aging which further incentivizes early planning for women who may want to prepare not only for widowhood but also for the cognitive decline of their husbands. Future work will specifically consider the effects of cognitive decline. Since the model shows declining incentives to invest after widowhood, it sheds some light on the stylized fact that widows have very low levels of financial knowledge. The model can also be applied more generally to the expected duration of the union rather than the expected timing of widowhood, so the same implications can be drawn for women facing varying probabilities of divorce.

One extension not yet considered is the availability of an outside option for dealing with

the shorter-living spouse's tasks. Instead of learning to manage her own wealth, she can have a third person, whether an adult child or a financial planner, manage her finances on her behalf. Indeed, the third-person option may be one reason why women react less strongly to a longer expected duration of widowhood.

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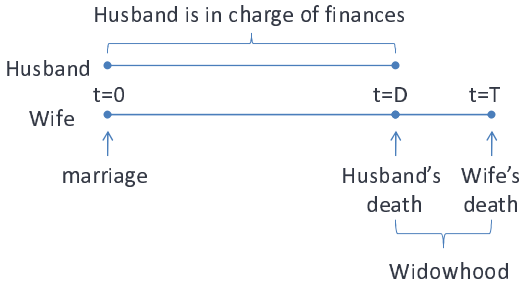
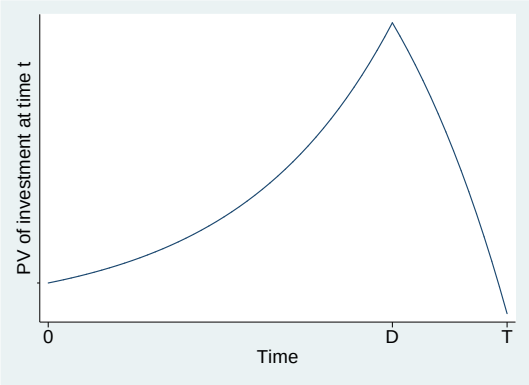
7 Figures and Tables

Figure 1: Timeline of analysis



The initial division of labor breaks down at time D.

Figure 2: Present value of an additional unit of human capital at time t



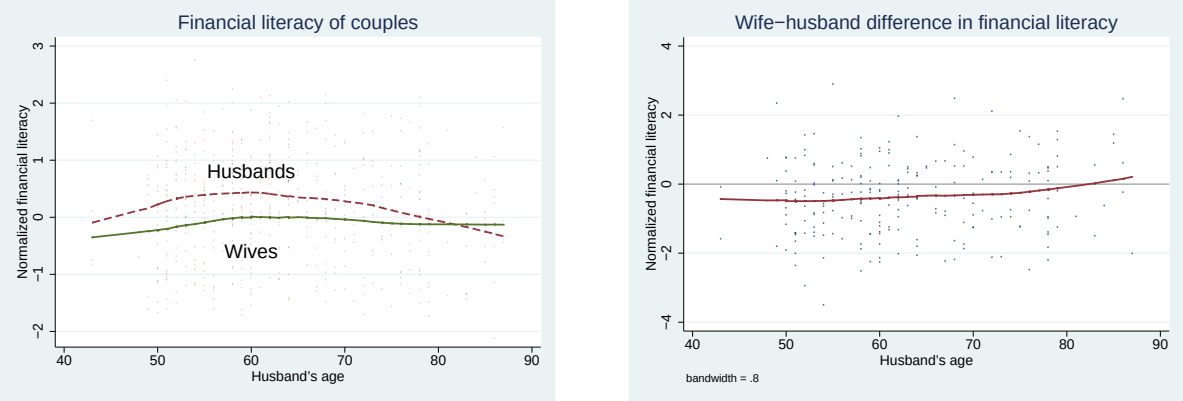
The payoffs to financial human capital are realized for the woman when she is a widow, for $T - D$ years. While her husband is still alive, the value of a marginal increase in financial human capital is discounted by the number of years a woman must wait until the stream begins ($D-t$ years). At time zero, the present value of the benefits are low due to the D-year delay until widowhood. The value increases as a woman approaches widowhood, at which point it declines because of the decreasing number of years the knowledge can be used.

Figure 3: A financial literacy question on CogEcon

Q30	Taxes affect how you should invest your money.											
	Most Likely False						Most Likely True					
	Surely False					Guess False	Guess True					Surely True
➡	100%	90%	80%	70%	60%	50%	50%	60%	70%	80%	90%	100%

Please Circle One Number

Figure 4: Financial literacy and husband's age

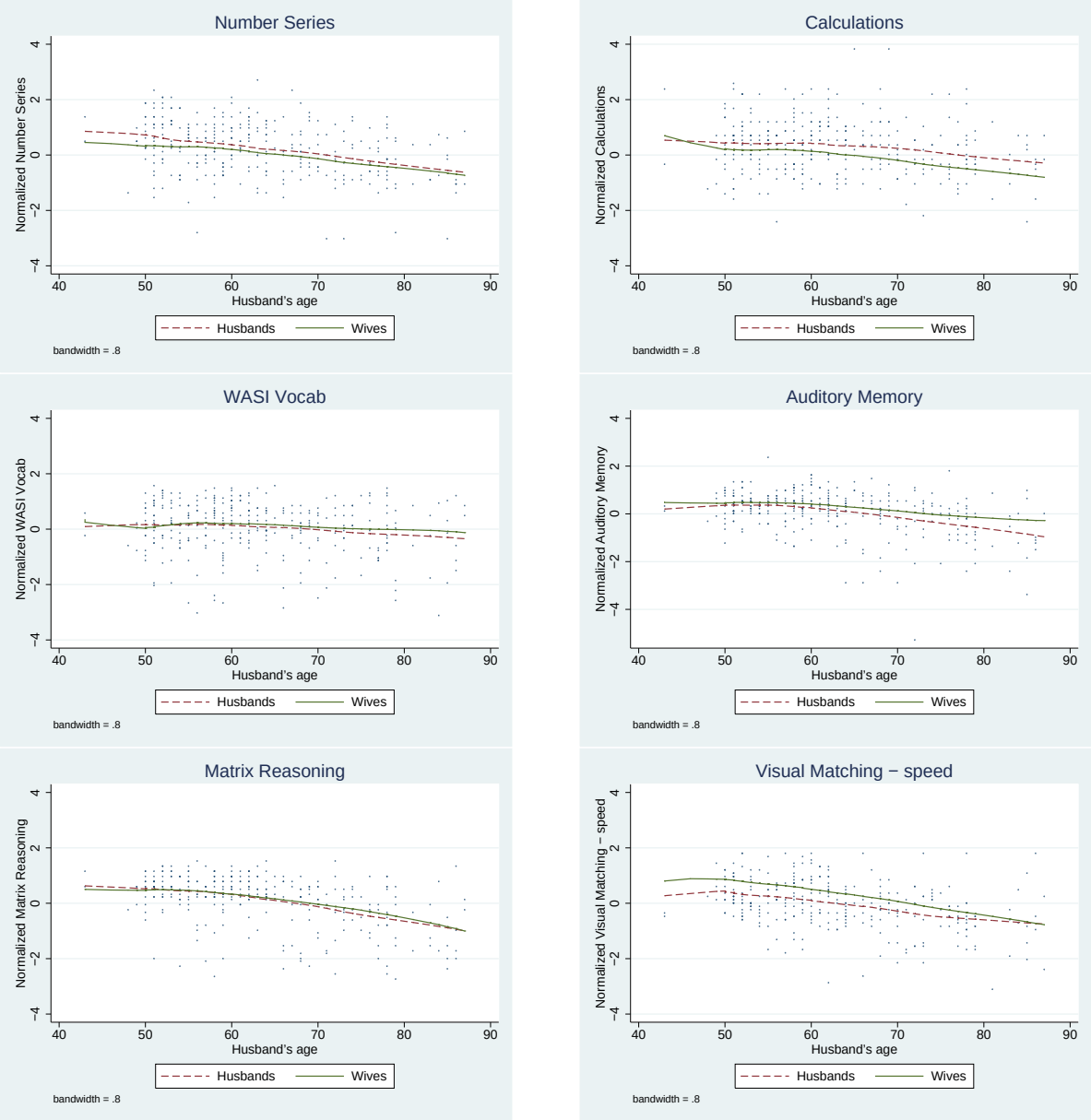


OLS regression of the right panel is reported in Table 6.

Figure 5: Financial literacy (no stock questions) and husband's age

OLS regression of the right panel is reported in Table 6.

Figure 6: Cognitive measures and husband's age



All scores are standardized. Unlike financial literacy, women's cognition scores do not systematically gain on their husband's scores. The cognition variables are detailed in Section 4.3.

Figure 7: U.S. historical age at first marriage

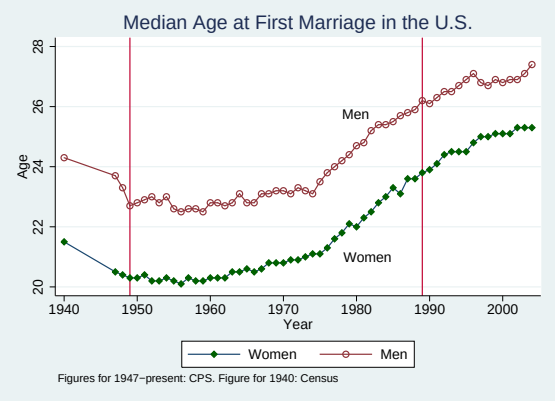
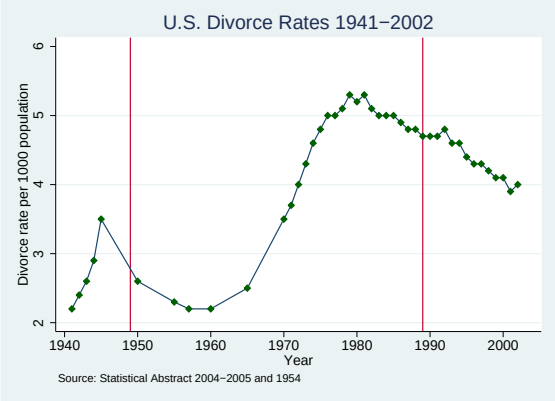


Figure 8: U.S. historical divorce rates



Vertical lines indicate the 5th and 95th percentile of year of first marriage among partnered respondents in the CogEcon sample. Younger women face greater incentives than older women to acquire financial literacy early in life.

Table 1: Ratio of the marginal effect of time to widowhood and length of widowhood on the value of human capital

Variable	**Mean**	**SD**	**Min**	**Max**
ratio with $\delta = 0.00$	1.52	0.15	1.21	2.23
ratio with $\delta = 0.03$	2.03	0.25	1.53	3.28
ratio with $\delta = 0.05$	2.38	0.33	1.663	4.00

If human capital depreciates, the effect of time to widowhood is even greater relative to the effect of the duration.

Table 2: Demographic characteristics of the analysis sample

Variable	Women		Men		Diff.
	Mean	N	Mean	N	
Age	60.53	224	62.86	224	-2.326 ***
	(9.44)		(10.04)		
Life expectancy (years)	24.00	224	19.25	224	4.758 ***
	(7.47)		(6.91)		
Years of education	14.42	224	14.65	224	-0.228 *
	(1.99)		(2.16)		
Who is most knowledgeable about finances?					
Me	0.161	223	0.491	216	-0.321 ***
	(0.367)		(0.501)		
Me OR Both of us	0.489	223	0.866	216	-0.372 ***
	(0.501)		(0.342)		

Standard deviations in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 3: Summary of regression variables

Variable	Mean	SD	N
Outcomes			
Wife-husband diff. in normalized financial literacy	-0.37	1.10	224
Wife-husband diff. in fin. literacy (no stock questions)	-0.31	1.25	224
Key explanatory variables			
Expected time to widowhood (years)	14.39	5.74	224
Expected length of widowhood (years)	12.92	2.87	224
Other regressors			
Husband's self-rated health (5 point scale)	3.63	1.00	224
Woman's self-rated health (5 point scale)	3.73	0.96	224
Husband's years of education	14.65	2.16	224
Woman's years of education	14.42	1.99	224
Woman's Number Series	0.15	0.859	224
Husband's Number Series	0.346	0.882	222
Woman's Visual Matching	0.442	0.86	224
Husband's Visual Matching	0.07	0.806	217
Woman's Auditory Working Memory	0.357	0.646	223
Husband's Auditory Working Memory	0.102	0.944	219
Woman's Matrix Reasoning	0.248	0.851	224
Husband's Matrix Reasoning	0.22	0.837	223

Table 4: Consistency of responses to "Who is most financially knowledgeable" within couples

	Wife's response					
Husband's response	Me	Partner	Both	Someone else	No Response	Total
Me	4	84	19	0	3	110
Partner	20	4	6	0	0	30
Both	15	20	47	1	0	83
Someone else	0	1	0	1	0	2
No response	0	5	3	0	0	8
Total	39	114	75	2	3	233

Only 10 couples (4%) report inconsistent answers about who is the household CFO, defined as the person who is most financially knowledgeable within the household.

Table 5: Comparative advantage and the division of labor: proportion of couples in which women have higher levels of characteristics than their husbands (mean differences in parentheses), by gender of CFOs

CFO	Age	Educ.	Normalized Number Series	Normalized Financial Literacy	N
Wife	0.250	0.417	0.472	0.583	36
Mean difference	(-1.33)	(0.69)	(0.13)	(0.30)	
Husband	0.134	0.214	0.304	0.259	112
Mean difference	(-2.60)	(-.62)	(-0.44)	(-0.71)	
Both	0.192	0.274	0.452	0.521	73
Mean difference	(-2.40)	(-.12)	(0.05)	(-0.16)	
Someone Else	0.000	0.500	1.000	0.500	2
Mean difference	(-4)	(2.5)	(0.91)	(0 .21)	
No Response	1.000	0.000	1.000	0.000	1
Mean difference	(1)	(-3)	(0.65)	(-2.10)	
Total	0.174	0.268	0.388	0.397	224
Mean difference	(-2.33)	(-0.23)	(-0.17)	(-0.37)	

The Household CFO is defined as the person who is most financially knowledgeable within the household. The CFO tends to be more educated, have more financial literacy, and have more fluid intelligence (as measured by the Number Series score) than his or her spouse; this is true for couples with male CFOs as well as those with female CFOs.

Table 6: Wife-husband difference in financial literacy and husband's age

	All questions	No stock questions
Husband's age	0.013	0.017
	(0.007)*	(0.008)**
Const.	-1.212	-1.379
	(0.466)***	(0.526)***
N	224	224
R^2	.015	.019
F	3.37	4.237

* significant at 10%; ** significant at 5%; *** significant at 1%

These regressions are OLS versions of the graphs on the right panels of 4 and 5. As the husband ages, the woman gains financial literacy relative to her husband.

Table 7: Financial literacy regressions (all questions)

	(1)	(2)	(3)
Expected time to widowhood	-0.035*	-0.037*	-0.040*
	(0.02)	(0.02)	(0.02)
Expected duration of widowhood	0.037	0.042	0.050
	(0.04)	(0.04)	(0.04)
Woman's education		0.057	0.012
		(0.04)	(0.05)
Husband's education		-0.111***	-0.086**
		(0.04)	(0.04)
Woman's health		0.045	0.022
		(0.08)	(0.08)
Husband's health		-0.080	-0.079
		(0.07)	(0.08)
Woman's Number Series			0.367***
			(0.13)
Husband's Number Series			-0.267**
			(0.12)
Woman's Visual Matching			-0.042
			(0.12)
Husband's Visual Matching			0.125
			(0.12)
Woman's Working Memory			0.036
			(0.14)
Husband's Working Memory			-0.032
			(0.10)
Woman's Matrix Reasoning			-0.175
			(0.13)
Husband's Matrix Reasoning			-0.017
			(0.13)
Constant	-0.349	0.526	0.920
	(0.38)	(0.74)	(0.95)
R^2	0.016	0.061	0.134
F	1.844	2.351	2.170
N	224	224	211

* significant at 10%; ** significant at 5%; *** significant at 1%

OLS regression with dependent variable: wife-husband difference in normalized financial sophistication score

Table 8: Financial literacy regressions (no stock questions)

	(1)	(2)	(3)
Expected time to widowhood	-0.042*	-0.044**	-0.046*
	(0.02)	(0.02)	(0.02)
Expected duration of widowhood	0.040	0.043	0.053
	(0.05)	(0.04)	(0.05)
Woman's education		0.079*	0.015
		(0.05)	(0.05)
Husband's education		-0.143***	-0.114**
		(0.04)	(0.05)
Woman's health		0.031	0.014
		(0.09)	(0.09)
Husband's health		-0.016	-0.008
		(0.08)	(0.09)
Woman's Number Series			0.437***
			(0.15)
Husband's Number Series			-0.260*
			(0.13)
Woman's Visual Matching			-0.078
			(0.13)
Husband's Visual Matching			0.010
			(0.13)
Woman's Working Memory			0.079
			(0.16)
Husband's Working Memory			-0.058
			(0.11)
Woman's Matrix Reasoning			-0.139
			(0.14)
Husband's Matrix Reasoning			-0.007
			(0.15)
Constant	-0.231	0.656	1.124
	(0.43)	(0.83)	(1.07)
R^2	0.019	0.069	0.143
F	2.161	2.670	2.344
N	224	224	211

* significant at 10%; ** significant at 5%; *** significant at 1%

OLS regression with dependent variable: wife-husband difference in normalized non-stock financial literacy score This table reproduces the regressions in Table 7, replacing the dependent variable with a financial literacy score that excludes all stock questions. The coefficients are qualitatively the same, but the effect of the time to widowhood is larger in magnitude here.

Table 9: Falsification tests: regressions using cognition outcomes

	Fin Lit	Calcu lation	Number Series	Matrix Reasoning	Verbal Analogies	Auditory Memory	Visual Matching
Time to	-0.039*	0.015	0.003	-0.028*	-0.014	-0.026	-0.013
widowhood	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Duration of	0.041	0.015	-0.017	0.029	0.009	-0.007	0.057
widowhood	(0.04)	(0.04)	(0.04)	(0.03)	(0.04)	(0.04)	(0.04)
Woman's	0.020	0.166**	0.015	0.158**	-0.045	0.104	0.122
health	(0.08)	(0.08)	(0.07)	(0.06)	(0.07)	(0.07)	(0.07)
Husband's	-0.065	-0.028	0.070	0.009	0.068	-0.073	0.041
health	(0.08)	(0.07)	(0.07)	(0.06)	(0.07)	(0.07)	(0.07)
Woman's	0.053	0.133***	0.178***	0.086**	0.137***	0.043	0.058
education	(0.04)	(0.04)	(0.04)	(0.03)	(0.04)	(0.04)	(0.04)
Husband's	-0.116***	-0.157***	-0.132***	-0.074**	-0.075**	-0.087**	-0.097***
education	(0.04)	(0.04)	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)
Constant	0.747	-0.867	-0.959	-0.727	-1.085	1.233*	-0.216
	(0.78)	(0.71)	(0.65)	(0.60)	(0.68)	(0.69)	(0.71)
R^2	0.068	0.122	0.121	0.074	0.065	0.064	0.058
F	2.474	5.010	4.938	2.894	2.469	2.431	2.137
N	211	223	222	223	219	219	217

* significant at 10%; ** significant at 5%; *** significant at 1%

OLS regression with dependent variables: wife - husband difference in normalized cognition. These falsification tests reproduce the regression in column (1) of Table 7, replacing the dependent variable with the wife-husband difference in cognition scores and omitting the cognition scores (Number Series, Auditory Memory, Visual Matching, and Matrix Reasoning) on the right hand side. The cognition variables are detailed in Section 4.3. Because the cognition scores are normalized, the coefficients are directly comparable with those estimated using the wife-husband difference in financial literacy in column (1).

Table 10: Summary of other financial knowledge outcomes

Variable	Mean	SD	Min.	Max.	N
Woman's self-rated financial skills	5.03	0.99	1	6	238
Woman's self-rated stock market understanding	2.95	1.36	1	6	232
Wife-husband difference in self-rated financial skills	0.01	1.48	-4	5	217
Wife-husband difference in self-rated stock market understanding	-0.77	1.63	-5	5	210
Woman's correct response to "Stocks historically outperform bonds?"	0.57	0.50	0	1	187
Woman's "How closely do you follow the stock market?"	0.66	0.63	0	2	212

Full text of these questions are found in Appendix A.3. Self-rated financial skills and stock market understanding: coded as 6 for "strongly agree" and 1 for "strongly disagree." Historical stock/bond returns: coded as 1 if respondents correctly reported that stock returns have exceeded bond returns. Follow the stock market: coded as 2 for "very closely," 1 for "somewhat" and 0 for "not at all."

Table 11: Regressions of other financial knowledge outcomes

	(1) Woman's Financial skills	(2) Woman's Stock market	(3) Difference Financial skills	(4) Difference Stock market	(5) Stocks returns (AME)	(6) Follow stock market
Expected time	-0.019	-0.033*	-0.020	-0.018	-0.017*	-0.029
to widowhood	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.02)
Expected duration	-0.064	0.043	-0.044	0.039	0.022	0.005
of widowhood	(0.04)	(0.04)	(0.04)	(0.04)	(0.02)	(0.05)
Woman's	-0.077*	0.055	-0.005	0.040	-0.019	0.017
education	(0.04)	(0.04)	(0.05)	(0.05)	(0.02)	(0.05)
Husband's	-0.024	-0.016	-0.090**	-0.104**	0.059***	-0.080*
education	(0.04)	(0.04)	(0.04)	(0.04)	(0.02)	(0.05)
Woman's	0.137*	0.172**	0.006	0.083	0.043	0.164*
health	(0.08)	(0.08)	(0.08)	(0.08)	(0.04)	(0.09)
Husband's	-0.067	-0.019	-0.110	-0.062	-0.030	-0.016
health	(0.07)	(0.07)	(0.07)	(0.07)	(0.03)	(0.09)
Woman's	0.124	0.142	0.360***	0.311**	0.163***	0.182
Number Series	(0.13)	(0.12)	(0.13)	(0.12)	(0.06)	(0.15)
Husband's	-0.076	0.103	-0.105	-0.053	-0.018	0.193
Number Series	(0.11)	(0.11)	(0.11)	(0.11)	(0.05)	(0.13)
Woman's	0.114	0.008	0.071	0.106	-0.051	-0.091
Visual Matching	(0.12)	(0.11)	(0.11)	(0.11)	(0.05)	(0.13)
Husband's	0.016	0.151	-0.088	0.027	-0.046	-0.016
Visual Matching	(0.11)	(0.11)	(0.11)	(0.11)	(0.05)	(0.12)
Woman's	0.081	0.036	0.171	-0.222	0.029	0.150
Working Memory	(0.13)	(0.13)	(0.13)	(0.14)	(0.06)	(0.15)
Husband's	0.046	-0.121	0.076	-0.055	0.013	-0.070
Working Memory	(0.10)	(0.10)	(0.09)	(0.10)	(0.05)	(0.11)
Woman's	0.124	-0.212*	0.040	-0.128	-0.043	-0.147
Matrix Reasoning	(0.12)	(0.12)	(0.12)	(0.12)	(0.06)	(0.13)
Husband's	0.075	0.016	-0.090	-0.095	0.002	0.189
Matrix Reasoning	(0.12)	(0.12)	(0.12)	(0.12)	(0.06)	(0.14)
N	236	230	215	208	182	209

* significant at 10%; ** significant at 5%; *** significant at 1%

Dependent variables: woman's self-rated financial skills and stock market skills; wife-husband differences in self-ratings, woman's knowledge that stocks have historically outperformed bonds, woman's closely following the stock market. Coefficients from ordered probit regressions reported in all columns, except column (5) which reports average marginal effects of a probit regression.

A Data appendix

A.1 Response rates

1,222 participants who completed the CogUSA study[18] were invited to complete the Cognitive Economics Survey. The invitees included 371 uncoupled individuals, 304 couples in which both members were invited (608 individuals) and 243 couples in which only one member was invited.

The reasons for which these 243 partners were not invited:

- 48 only partially completed the CogUSA study
- 138 refused to participate in the CogUSA study
- 24 did not provide an interview for CogUSA for unspecified reasons
- 4 were removed from the CogUSA sample for unknown reasons
- 4 were not interviewed by CogUSA due to language problems
- 25 were physically or mentally unable to conduct the CogUSA telephone interview.

CogEcon had an overall response rate of 80.61 percent, yielding a sample size of 985 respondents. Response rates of mutually exhaustive sub groups:

- uncoupled individuals: $286/371 = 77.09\%$
- members of couples in which both members were invited: $512/608 = 84.21\%$
- individuals whose partners were not invited: $187/243 = 76.95\%$.

These response rates yielded the following CogEcon respondents:

- 286 uncoupled individuals
- 468 coupled individuals whose partners also completed CogEcon
- 44 coupled individuals who completed CogEcon but whose partners completed CogUSA only
- 187 coupled individuals who completed CogEcon but whose partners did not complete CogUSA.

Among the 304 couples with both members invited to CogEcon, there were 26 couples with no respondents, and 42 couples with one respondent (half of whom were male, half were female). The remaining couples provided one complete survey for each individual.

Among the 851 invitees in couples, men responded at a rate that was about 2 percentage points higher than women, though the difference is not statistically significant.

[18]The 2008 wave of the CogUSA study was conducted in two stages, a telephone interview, then a face-to-face interview. Of the 3224 contacted for the telephone interview, 1514 completed this interview, for a response rate of 47 percent that was on target for a Random Digit Dialing sample methodology. 1230 (81 percent) of telephone respondents completed a face-to-face interview. Respondents and non-respondents to the face-to-face interview were not statistically significantly different at the 5 percent level in terms of cognition (Serial 7s and Mental Status), age, sex, race, couple status, and self-rated health status . Respondents had, on average, .36 more years of education ($p < 0.2$).

A.2 Derivation of the analysis sample

The Cognitive Economics survey is composed of 985 individuals in 751 households (including 286 singletons). To construct my sample, I drop the 286 singletons as well as those in same sex couples (3 couples in total). Doing so leaves 462 households, which are composed of

- 233 couples about which we have full information (cognition data from CogUSA and financial knowledge data from CogEcon),
- 21 couples for which we have full information about the wife and cognition data only about the husband,
- 21 couples for which we have full information about the husband and cognition data about the wife, and
- 187 couples with only one respondent with no information about the partner.

When the wife-husband difference in financial sophistication is used as the dependent variable, the maximum sample possible is the 224 couples from which both members completed at least part of the financial literacy battery in CogEcon in addition to CogUSA. The dependent variable here is constructed using CogEcon responses from both members of the couple. Due to item non-response for some variables, actual sample sizes will vary according to the specification used.

A.3 Survey questions used in the analysis

A.3.1 Financial literacy questions in CogEcon

The following tables list the question number and the text of both true and false versions of each financial literacy question on the Cognitive Economics survey, with the mean score on each question for women and men in the 224 couples in the sample. All of these questions have been fielded on the RAND American Life Panel (Delavande et al., 2008); 16 of these questions were also fielded on the 2008 wave of the Health and Retirement Study (Lusardi et al., 2009), and twelve are currently being fielded on the Wisconsin Longitudinal Study.

	Text of questions related to stocks	
	True Version	**False Version**
18	Financially, investing in the stock market is better than buying lottery tickets.	Financially, investing in the stock market is no better than buying lottery tickets.
19	When an investor spreads money between 20 stocks, rather than 2, the risk of losing a lot of money decreases.	When an investor spreads money between 20 stocks, rather than 2, the risk of losing a lot of money increases.
22	Mutual funds do not pay a guaranteed rate of return.	Mutual funds pay a guaranteed rate of return.
24	It is easy to find mutual funds that have annual fees of less than one percent of assets.	It is hard to find mutual funds that have annual fees of less than one percent of assets.

25	Even if you are smart, it is hard to pick individual company stocks that will have better than average returns.	If you are smart, it is easy to pick individual company stocks that will have better than average returns.
28	It is possible to invest in the stock market in a way that makes it hard for people to take unfair advantage of you.	There is no way to avoid people taking advantage of you if you try to invest in the stock market.
31	An employee of a company with publicly traded stock should have little or none of his or her retirement savings in the company's stock.	An employee of a company with publicly traded stock should have a lot of his or her retirement savings in the company's stock.
33	It is a good idea to own stocks of foreign companies.	It is best to avoid owning stocks of foreign companies.
34	Even older retired people should hold some stocks.	Older retired people should not hold any stocks.
35	You should invest in either mutual funds or a large number of different stocks instead of just a few stocks.	You should invest most of your money in a few good stocks that you select rather than in lots of stocks or in mutual funds.
36	To make money in the stock market, you should not buy and sell stocks too often.	To make money in the stock market, you have to buy and sell stocks often.
39	It is better for young people saving for retirement to combine stocks with long-term (inflation protected) bonds than with short-term (inflation protected) bonds.	It is better for young people saving for retirement to combine stocks with short-term (inflation protected) bonds than with long-term (inflation protected) bonds.
40	If you invest for the long run, the annual fees of mutual funds are important.	If you invest for the long run, the annual fees of mutual funds are unimportant.
41	Buying a stock mutual fund usually provides a safer return than a single company stock.	Buying a single company stock usually provides a safer return than a stock mutual fund.

	Text of questions not related to stocks	
	True Version	**False Version**
17	An investment advisor tells a 30-year-old couple that $1,000 in an investment that pays a certain, constant interest rate would double in value to $2,000 after 20 years (by the time they are 50). If so, that investment would be worth $4,000 after 40 years (by the time they are 70).	An investment advisor tells a 30-year-old couple that $1,000 in an investment that pays a certain, constant interest rate would double in value to $2,000 after 20 years (by the time they are 50). If so, that investment would not be worth $4,000 for at least 45 years (until they are at least 75).

20	If you start out with $1,000 and earn an average return of 10% per year for 30 years, after compounding, the initial $1,000 will have grown to more than $6,000.	If you start out with $1,000 and earn an average return of 10% per year for 30 years, even after compounding, the initial $1,000 will have grown to less than $6,000.
21	The more you diversify among stocks, the more of your money you can invest in stocks.	The more you diversify among stocks, the less of your money you should invest in stocks.
23	Young people should hold somewhat riskier financial investments than older people.	Older people should hold somewhat riskier financial investments than young people.
26	Using money in a bank savings account to pay off credit card debt is usually a good idea.	Using money in a bank savings account to pay off credit card debt is usually a bad idea.
27	You could save money in interest costs by choosing a 15-year rather than a 30-year mortgage.	You could save money in interest costs by choosing a 30-year rather than a 15-year mortgage.
29	If the interest rate falls, bond prices will rise.	If the interest rate falls, bond prices will fall.
30	Taxes affect how you should invest your money.	Taxes do not affect how you should invest your money.
32	For a family with a working husband and a wife staying home to take care of their young children, life insurance that will replace three years of income is not enough life insurance.	For a family with a working husband and a wife staying home to take care of their young children, life insurance that will replace three years of income is more than enough.
38	It is important to take a look at your investments periodically to see if you need to make changes.	Once you have made an initial decision about the investment mix for your portfolio, you should avoid making changes to your portfolio until you are close to retirement.

A.3.2 Other measures of financial knowledge in CogEcon

Questions asked on the Cognitive Economics 2008 Survey (answer choices in parentheses):

Self-rated financial knowledge Question 12: I am good at dealing with day-to-day financial matters, such as checking accounts, credit cards, mortgages, installment payments, and budgeting. (Strongly agree, agree, slightly agree, slightly disagree, disagree, strongly disagree).

Self-rated stock knowledge Question 10: I understand the stock market reasonably well. (Strongly agree, agree, slightly agree, slightly disagree, disagree, strongly disagree).

Questions asked on the Cognitive Economics 2009 Survey (answer choices in parentheses):

Historical knowledge Question 89: On average *over the last 100 years*, how do you think the *annual rate of return on stocks* has compared to *the annual rate of return on bonds*? (Stock returns have been higher than bond returns, bond returns have been higher than stock returns, both returns were the same).

Following the stock market Question 82: How closely do you follow the stock market? (Very closely, somewhat, not at all).

B Equations for life table widowhood measures

Suppose that the current age of the wife is x and the age of the husband's age is y at the time of the survey. Let l_d^f be the woman's life table probability of surviving from birth to age d and l_d^m the husband's life table probability of surviving from birth to age d. Let q_d^m be the life table probability that the husband dies at age d (this is the life table one-year mortality rate at age d). The probability that the woman becomes a widow t years from the survey is the joint probability that woman is alive in t years, the man is alive in t years, and that the man dies at age $(y+t)$, conditional on the woman and her husband both being alive at ages x and y, respectively:

$$f(x,y,t) = \frac{l_{x+t}^f}{l_x^f}\frac{l_{y+t}^m}{l_y^m}q_{y+t}^m. \tag{6}$$

The probability that a woman will outlive her husband is thereforethe sum of $f(x,y,t)$ over all possible years of the onset of widowhood:

$$Pr(\text{woman outlives her husband}) = \sum_{t=0}^{\infty} f(x,y,t). \tag{7}$$

The expected time to widowhood and the the expected duration of widowhood, conditional on a woman outliving her husband, is:

$$E[\text{Time to widowhood}|\text{woman outlives husband}] = \frac{\sum_{t=0}^{\infty}(t)f(x,y,t)}{\sum_{t=0}^{\infty} f(x,y,t)} \tag{8}$$

$$E[\text{Length of widowhood}|\text{woman outlives husband}] = \frac{\sum_{t=0}^{\infty}(e_{x+t}^f)f(x,y,t)}{\sum_{t=0}^{\infty} f(x,y,t)} \tag{9}$$

where e_{x+t}^f is the woman's remaining life expectancy at age $x+t$.

C Robustness: Probabilistic survival measures

As a further robustness check, I use alternative survival measures constructed using a few special features of the CogEcon data. While life table measures mask much of the variation in actual survival expectations, I use probabilistic subjective survival expectations and objective survival probabilities predicted using each person's observable characteristics. Converting probabilistic measures to measures in time units as implied by the model and used in the main analysis would require strong assumptions about the shape of each individual's entire survival function, so I leave these survival measures in their probabilistic form. Equation (5) is re-estimated replacing the time to widowhood with the husband's probability of surviving at least another ten years, and the length of widowhood with the wife-husband difference in their respective ten-year survival probabilities. These results generally confirm that the lower the husband's survival probability (and therefore the more imminent widowhood is), the greater the wife's level of financial knowledge.

Life table survival probabilities As a baseline, I draw ten-year-ahead survival probabilities from the 2004 period life tables. These are defined as $\prod_{x=age}^{10}(1-q(x))$, where $q(x)$ is the life table hazard of dying between age x and $x+1$. As in the main analysis, using life tables requires the assumption that a woman's expectation of the timing and length of widowhood are, in expectation, the same as those in these life tables.

Subjective survival probabilities Individual expectations are likely to deviate heterogeneously from these population measures. I use subjective survival probability questions that are asked of each CogEcon respondent in the second wave of CogUSA. These questions ask "What is the percent chance that you will live to be X or more?" where X is an age that is between 11 and 15 years in the future (or more for spouses who are younger than 50).

Because the time horizon of the subjective survival questions varies, responses for different time horizons are not comparable at face value. I interpolate a 10-year-ahead survival probability by assuming assuming that one-year hazard rates are constant over the 11-15 year horizons.[19] These probabilities have a 0.56 correlation with life table probabilities, with a wife-husband difference that is smaller than the life tables (see Table C.1).

A number of studies have analyzed the relationship between subjective survival probabilities and actual mortality. Subjective probabilities have been shown, on average, to be close to those in life tables, and they covary with health conditions, smoking and socio-economic status in the same way as actual mortality outcomes (Hurd and McGarry, 1995). The probabilities are consistent with individuals' observed mortality patterns (Elder, 2010; Smith et al., 2001) and are updated by individuals in response to new information like the onset of health conditions (Hurd and McGarry, 2002; Smith et al., 2001).

Since one can argue that individual life-cycle behavior reflects subjective beliefs rather than actuarial probabilities, subjective probabilities are suited for use in robustness checks. This strategy assumes that a woman's beliefs about her husband's mortality are identical to her husband's own beliefs about his own mortality.[20]

[19] I retain the original values of those who report 0 and 100 percent probabilities.

[20] Unfortunately for my analysis, to my knowledge no surveys that field these subjective survival expecta-

Objective predicted survival probabilities (HRS) Because CogEcon and the Health and Retirement Study share many socio-demographic, cognitive and physical health measures, one can use the effect of these variables on observed mortality in HRS to predict mortality for CogEcon respondents.

I estimate a probit model of survival using respondents of the 1998 wave of the HRS and their survival outcomes as of 2008. The covariates include gender, race, years of education, couple status, birth year, episodic memory, mental status, depressive symptoms, an index of health measures, self-rated health, smoking status, and alcohol consumption, all measured in 1998. I use the estimated parameters to predict ten-year survival for CogEcon respondents. These predicted probabilities have a 0.83 correlation with life table probabilities, and have less variance and are of higher levels than the subjective probabilities (see Table C.1).

Estimation with predicted survival probabilities uses a two-stage procedure in which mortalities are predicted in the first stage using HRS data, and the main equation of interest is estimated in the second stage. Since the objective survival probabilities are predicted with error, the variance-covariance matrix of the main estimating equation will require an adjustment for the generated regressors. I use the two-step maximum likelihood estimation described in Murphy and Topel (1985). Due to the large sample size of the first-stage HRS estimates, the correct standard errors are only slightly larger than the uncorrected ones.

C.1 Results with alternate probabilistic life measures

Regression results are reported in Table C.2. The first column presents results using the ten-year probabilities from U.S. life tables; the second from subjective survival probabilities, and the third from objective predicted probabilities. Since all of these measures are ten-year survival probabilities, the coefficients on the husband's survival probabilities and the wife-husband difference in probabilities are comparable across specifications. However, since the first and last columns are based on averages (by age and sex for life tables, and for various personal characteristics in the case of the HRS estimates), I expect these coefficients to be estimated with less precision. On the other hand, the subjective survival measures are subject to survey noise and rounding[21], which should lead to attenuation bias.

All of the regressions reported in Table C.2 show that the effect of husbands' survival probabilities on non-stock financial literacy is negative, as predicted by the model, though the estimates are not statistically significant. With subjective probabilities, a ten percent decrease in husband's survival probability is associated with an increase in the woman's financial literacy of 0.07 standard deviations over her husband's score. While the signs of the effect of husband's survival probabilities are consistent with the model's predictions, the estimated magnitudes appear to be small. Regressions with all financial literacy questions yield similar results.

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tions questions query both members of a couple about their spouse's survival prospects.

[21]Manski and Molinari (2010) find evidence of rounding in expectations questions on the HRS. CogEcon asks a number of follow-up questions in the expectations module that suggest the rounding that occurs is symmetric. If noise is introduced through rounding or through general survey noise like classical measurement error, these measures will produce attenuation bias in my estimates.

Table C.1: Robustness check: Summary of 10-year survival probabilities

Measure	**Variable**	**Mean**	**SD**	**Min**	**Max**	**N**
Life table	Husband	0.72	0.21	0.10	0.95	238
	Wife - husband	0.11	0.10	-0.07	0.65	238
Subjective -	Husband	0.71	0.24	0	1	224
constant hazard	Wife - husband	0.05	0.27	-0.83	0.77	214
HRS predicted	Husband	0.87	0.16	0.21	0.99	216
probabilities	Wife - husband	0.08	0.13	-0.20	0.62	215

Table C.2: Robustness check: Financial literacy regressions (no stock questions) using 10-year survival measures

	Life table 10-year survival	Sub-jective survival	HRS predicted
Husband's Pr(Surv)	-0.702	-0.704	-0.422
	(0.78)	(0.59)	(1.22)
Difference in Pr(Surv)	0.112	-0.483	1.503
	(1.38)	(0.48)	(1.44)
R^2	0.137	0.156	0.153
F	2.228	2.330	2.495
N	211.000	192.000	208.000

* significant at 10%; ** significant at 5%; *** significant at 1%

Dependent variable: wife-husband difference in normalized financial literacy scores, excluding stock questions. Control variables: wives' and husbands' health, education, Number Series, Visual Matching, Working Memory, and Matrix Reasoning.